Wireless Emergency Alerts
6 April 2008

DeWayne Sennett
KE7DXW
425-802-8946
ke7dxw@comcast.net

Outline

- Definition of Wireless Emergency Alerts
- CMSAAC Recommendations
- Mobile Device Functionality for Wireless Emergency Alerts
- Cell Broadcast for Wireless Emergency Alerts
- Regulations & Standardization
- Wireless Emergency Alerts & Amateur Radio

Definition of Wireless Emergency Alerts

What Are Wireless Emergency Alerts?

- **Only alerts that are immediate, severe, or likely threat to life, health or property will be delivered to mobile devices**
  - Limited to imminent threat to life & property
  - Minimize the “cry wolf” syndrome
  - Notification service not information service
  - Limitations on number of text characters that can be broadcast and displayed
- **Wireless alerts are only one component to an overall effective emergency notification strategy**
  - Supplements existing emergency notification systems such as Radio/TV-based EAS and National Weather Service All-Hazards Radio
- **Limited to Commercial Mobile Service Providers (CMSPs)**
  - Includes pagers and cellular mobile devices
  - Excludes
    - Radio broadcasters, TV broadcasters, Satellite broadcasters
    - Public Safety communications systems (e.g., 800 MHz systems)
    - Data-only devices such as air cards

WARN Act Overview

- WARN Act → "Warning, Alert, and Response Network" Act
- U.S. Congress passed the WARN Act as part of SAFE Port Act on September 20, 2006
  - Signed by U.S. President George W. Bush on Friday October 13th, 2006
- Required FCC to establish the Commercial Mobile Service Alert Advisory Committee (CMSAAC) within 60 days of enactment
  - First meeting was December 12, 2006 & last meeting was October 3, 2007
  - Membership by appointment of the FCC Chairman
  - Tasked for development of system-critical recommendations

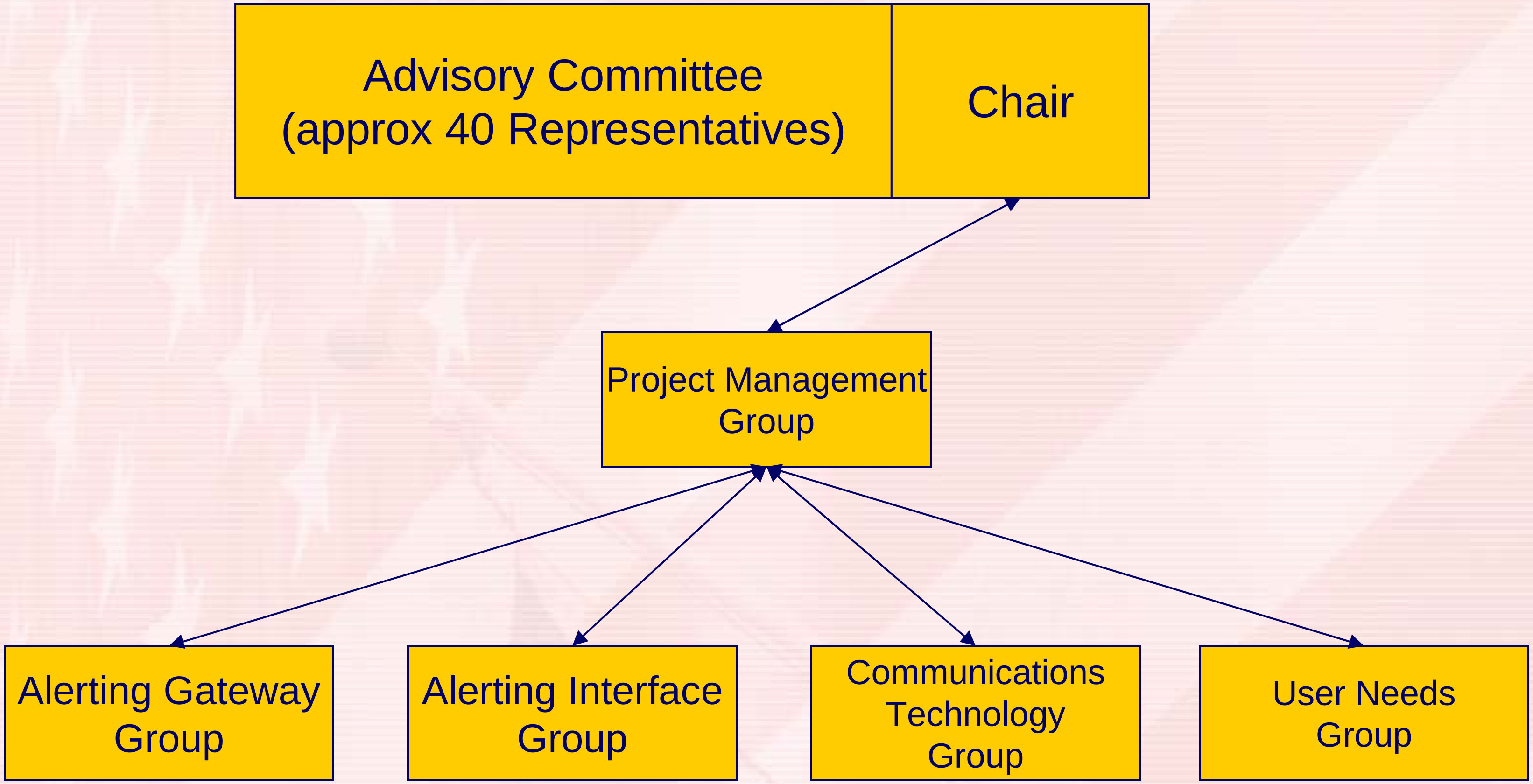
Overview of the CMSAAC

- Purpose
  - Develop and submit to FCC recommendations regarding technical standards and protocols to enable participating CMSPs to transmit emergency alerts to subscribers

  - Recommendations due to FCC one year from WARN Act enactment (due October 12, 2007)

- Comprised of a wide range of stakeholders, including representatives from state, local, and tribal governments; vendors, developers and manufacturers; technical experts; other governmental agencies; and wireless service providers

CMSAAC Organization



Advisory Committee
(approx 40 Representatives)

Chair

Project Management Group

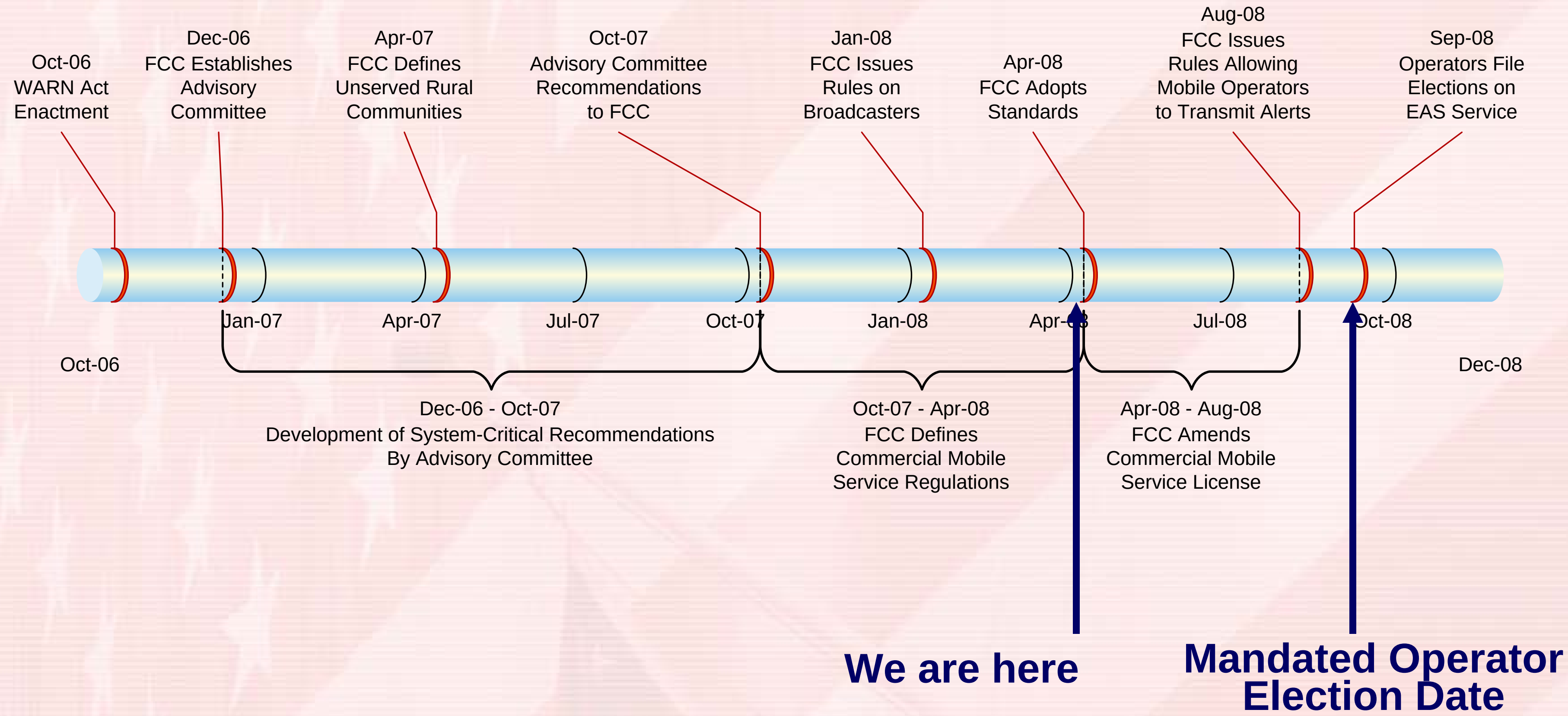
Alerting Gateway Group

Alerting Interface Group

Communications Technology Group

User Needs Group

WARN Act Milestones



Oct-06
WARN Act
Enactment

Dec-06
FCC Establishes
Advisory
Committee

Apr-07
FCC Defines
Unserved Rural
Communities

Oct-07
Advisory Committee
Recommendations
to FCC

Jan-08
FCC Issues
Rules on
Broadcasters

Apr-08
FCC Adopts
Standards

Aug-08
FCC Issues
Rules Allowing
Mobile Operators
to Transmit Alerts

Sep-08
Operators File
Elections on
EAS Service

Jan-07
Apr-07
Jul-07
Oct-07
Jan-08
Apr-08
Jul-08
Oct-08

Oct-06

Dec-08

Dec-06 - Oct-07
Development of System-Critical Recommendations
By Advisory Committee

Oct-07 - Apr-08
FCC Defines
Commercial Mobile
Service Regulations

Apr-08 - Aug-08
FCC Amends
Commercial Mobile
Service License

We are here

Mandated Operator Election Date

Key WARN Act Requirements

- **Voluntary → Commercial Mobile Service Providers (CMSP) are required to make an Election to Transmit or Not Transmit Emergency Alerts in September 2008**
  - Elections can be “in whole or in part”
  - If elect not to transmit, must notify subscribers and provide notification at point-of-sale
  - If elect to transmit, must comply with standards, protocols, procedures, and regulations adopted by FCC
- **For CMSPs that Elect to Transmit Alerts:**
  - Presidential-level Alerts must be transmitted
  - May offer subscriber opt-out capability for other classes of alerts
  - No Fee for Service
  - Transmission in languages in addition to English to the extent practical and feasible
- **Liability Protections, including:**
  - “any act or omission related to or any harm resulting from the transmission of, or the failure to transmit, and emergency alert”

CMSAAC Recommendations

CMSAAC Recommendations Background

- Industry Consensus View
  - Cellular Operators
  - Paging Carriers

- Multiple stakeholders
  - Federal, state, local, tribal, industry, broadcast, special needs

- Extremely Complex Issue
  - 10 month analysis
  - Over 40 CMSAAC members and numerous Subject Matter Experts participated
  - Numerous meetings & conference calls
  - Approximately 1,000 documents presented and reviewed
  - Output → 101 page recommendations document

CMSAAC General Recommendations

- **Three classes of Commercial Mobile Alerts:**
  - Presidential-level
  - Imminent threat to life and property
  - Child Abduction Emergency or “AMBER Alert”

- **Only alerts that are immediate, severe, or likely threat to life, health or property will be delivered to mobile devices**
  - Minimize the “cry wolf” syndrome
  - Commercial Mobile Alert Service (CMAS) is a notification service
  - Limitations on number of text characters that can be broadcast and displayed

- **Federal, state, tribal, and local level CMAS alert messages will be supported using the same CMAS solution**

- **Common experience across all CMSPs & technologies is desirable**
  - Common alert tone and/or vibration cadence used only for CMAS messages

CMSAAC General Recommendations

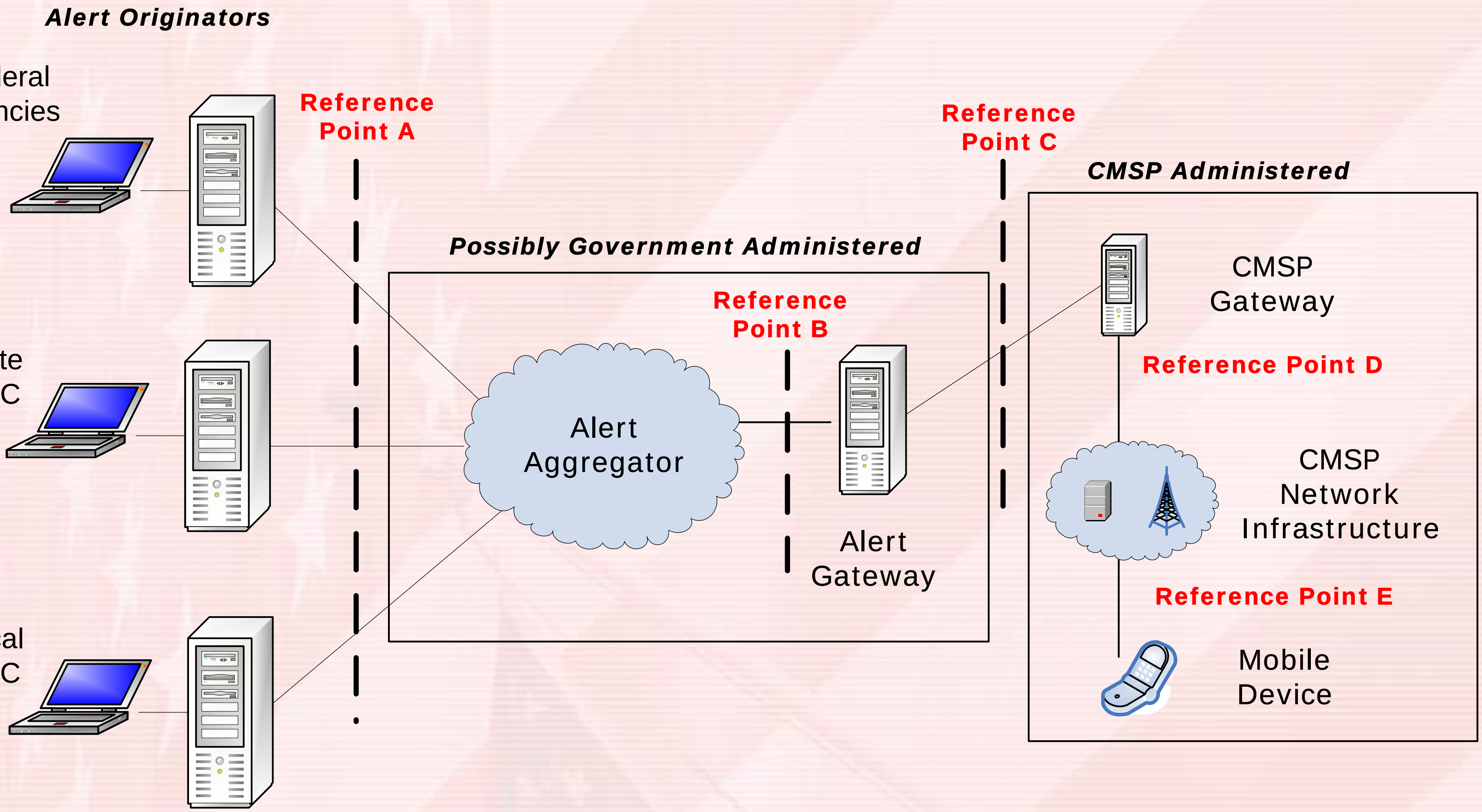
- CMSPs who elect to support CMAS are considered for this purpose only to be agents of the federal, state, local, or tribal agencies that originate the alerts and are providing CMAs on their behalf

- CMAS will be provided according to the technical standards, protocols, procedures, and other technical requirements implemented by the Commission to support the WARN Act

- CMSP networks shall not be bound to use any specific vendor, technology, software, implementation, client, device, or third party agent, in order to meet the obligations under the WARN Act

- Technical standards, protocols, procedures, and other technical requirements implemented by the Commission shall be standardized in industry fora

CMSAAC Reference Architecture

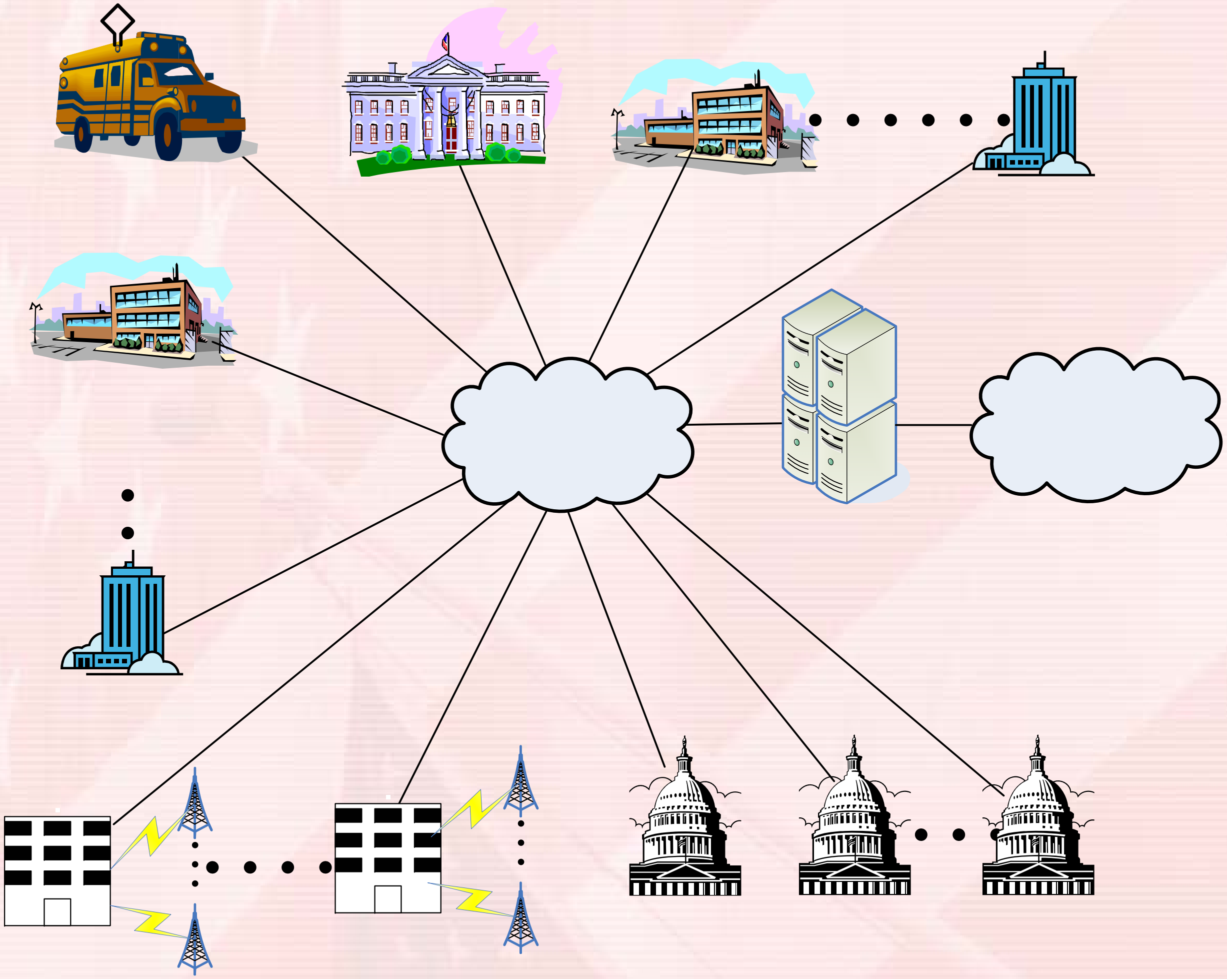


Why An Alert Aggregator?

- Current EAS distribution system designed to support local distribution of emergency alerts to local broadcasters
  - No provisions to support distribution for national carriers
  - No provisions for the authentication of emergency alert initiators
    - Approximately 50,000 on national basis

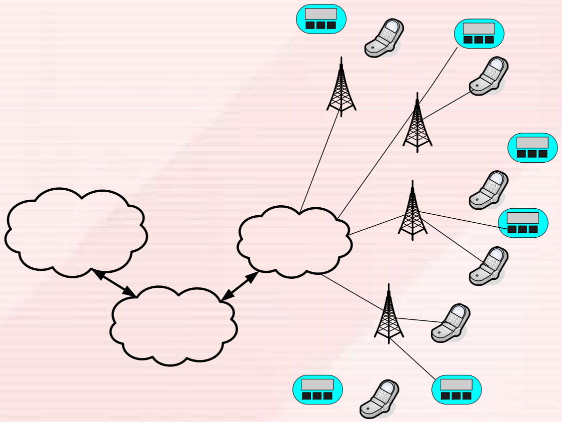
- Implications to National CMSPs if No Alert Aggregator
  - Multiple interfaces to multiple sources (4,000+)
    - 50 states
    - District of Columbia
    - Territories (e.g., Puerto Rico)
    - National Weather Service (121 Weather Offices)
    - Federal agencies
    - Potential of 3,077 counties & numerous local jurisdictions
    - Large municipalities
  - Multiple protocols from multiple sources
  - Authorization and authentication of 50,000+ alert initiators nationwide

What CMSPs Want

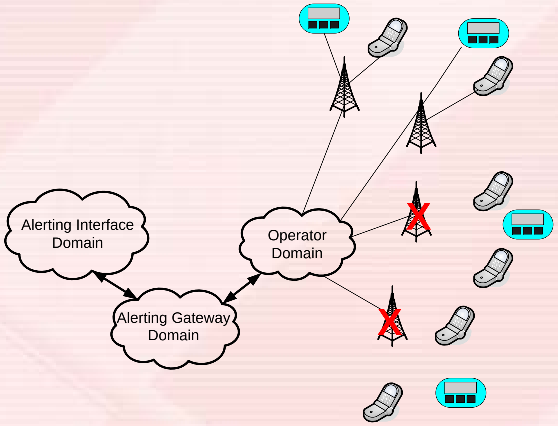


Deployment Scenarios

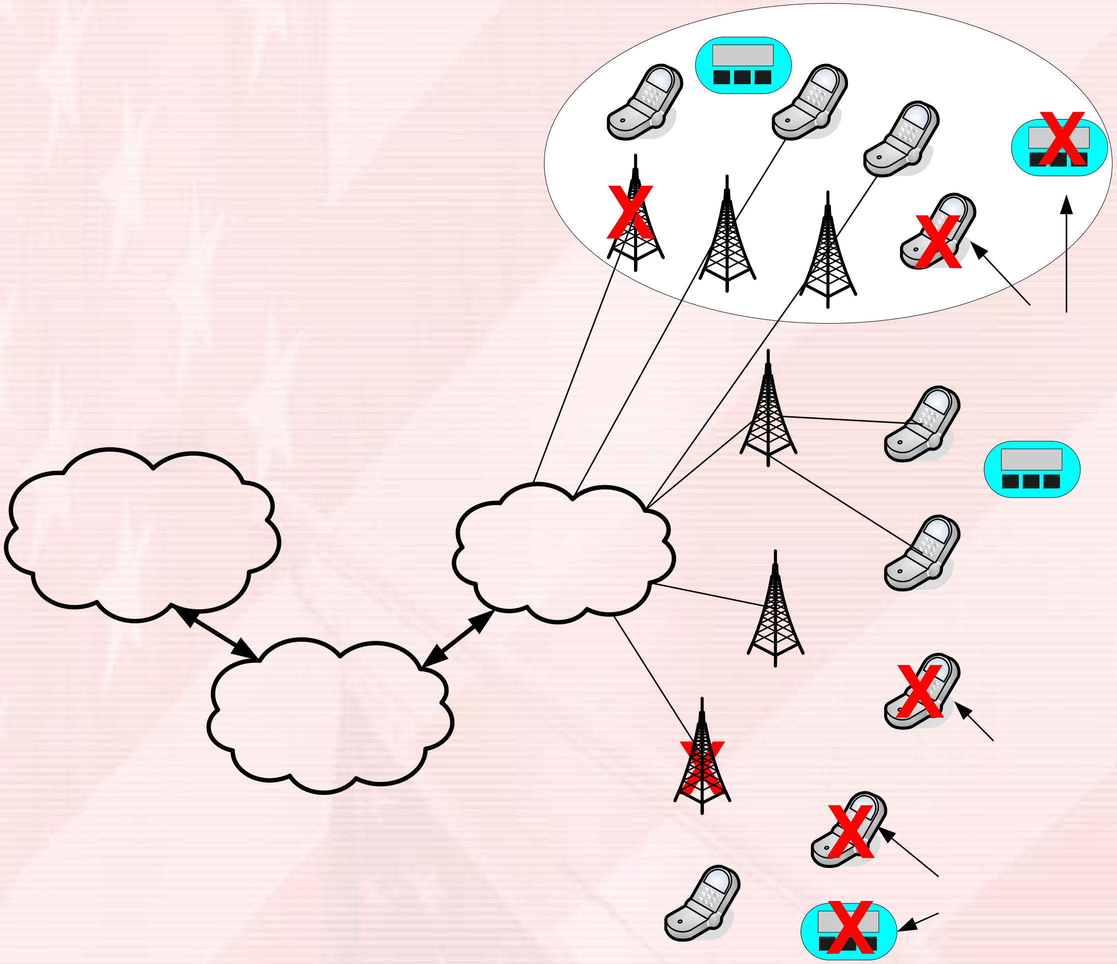
- WARN Act specifies that a commercial mobile service operator who elects to transmit emergency alerts can elect to transmit the CMAS alerts “in whole or in part”



- “In whole or in part” include the following:
    - All or a subset of the CMSP’s service area
    - All or a subset of current and future mobile devices supported by the CMSP network



Likely Deployment Scenario



Wireless Emergency Alerts Delivery Technology

- CMSAAC recommendations based upon service profiles
  - No specific delivery technologies recommended by CMSAAC
  - Support of text service profile required, if CMSP elects to transmit alerts
  - Audio, video, and multimedia service profiles for future study

- Point-to-point delivery technologies such as SMS or MMS not feasible nor practical
  - Especially on a nationwide, statewide, or large city scale
  - Point-to-point technologies will quickly congest a network, resulting in significant message delays or messages not delivered, as well as denying voice services including 911 calls

- Broadcast technology required for effective distribution
  - Uni-direction broadcast of information
  - No response or acknowledge from mobile device
  - Broadcast to all subscribers in alert area

CMAS Alert Message Format

- **90 English character text-based message**
  - Text viewed as the lowest common denominator
  - Must account for all mobile devices, low end to high end
  - Streaming audio & video, multimedia defined for future consideration
- **Contents of the message:**
  - What's Happening (Event Type or Event Category)
  - Area affected (in this area)
  - Recommended action (Response description)
  - Expiration time with time zone (Represented as a distinct time – e.g., until 09:30 AM EDT)
  - Sending Agency (agency type, i.e. police, fire, national weather service, etc.)
- **Message shall not contain phone numbers or URLs**
  - Would encourage mass access & would causing severe network congestion
- **Automatic generation of alert message based upon CAP parameters**
  - Free form alert message text for Presidential Alerts & AMBER Alerts
  - Free form could be allowed for other alert originators after adequate training.

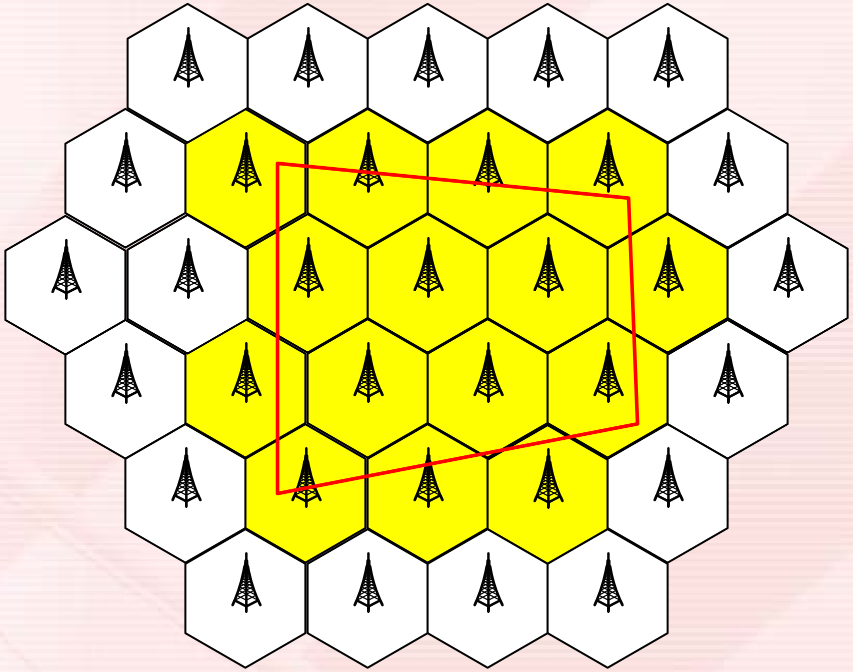
CMSAAC Geo-Targeting Recommendations

- Geo-targeting to county level is minimum recommended requirement
- CMSP may elect to target small areas subject to technology capabilities & operator policy
- CMSP not required to dynamically match alert geography to RF coverage areas
- CMSP shall not be required to divulge cell site information, coverage information, or any RF properties of their respective networks

Geo-Targeting

- Mapping of alert area to cell sites is CMSP function
- Minimum is county basis
  - If alert area crosses multiple counties, alert sent to each county
- CMSP can choose to broadcast only to alert area indicated by polygon or circle

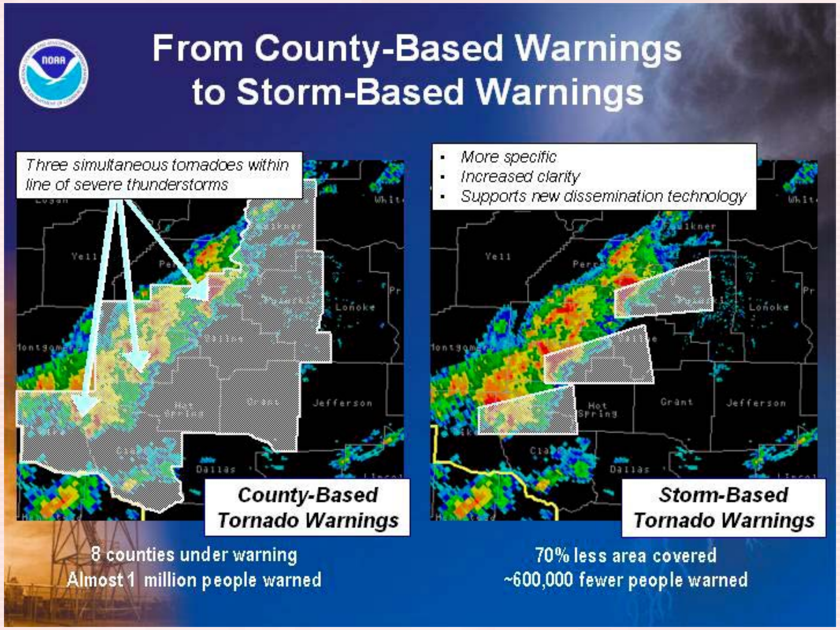
- Red polygon is alert area
- Yellow cell sites are those providing coverage within polygon



Why Did CMSAAC Recommend County Level?

1. Ease of development & maintenance of cell site coverage
   - At the county level, a pre-defined static list of cell sites covering the county can be developed
   - Alerts can be sent to the entire county to provide sufficient coverage

2. Dynamic generation of list of cell sites covering the alert area is a more challenging task
   - Requires more operational support to develop and maintain lists, especially with >50k sites



From County-Based Warnings to Storm-Based Warnings

Three simultaneous tornadoes within line of severe thunderstorms

- *More specific*
- *Increased clarity*
- *Supports new dissemination technology*

County-Based Tornado Warnings

8 counties under warning
Almost 1 million people warned

Storm-Based Tornado Warnings

70% less area covered
~600,000 fewer people warned

Recommendation for Future Geo-targeting

- Federal Government to initiate a research, development, testing, and evaluation program to develop innovative technologies that will allow service providers to efficiently transmit geo-targeted wireless alerts
  - May be part of the recommended biennial CMAS review process
- Formation of a government-led industry group
  - Identify no later than August 2008 certain urban areas with populations exceeding 1,000,000 inhabitants or with other specialized alerting needs for priority consideration regarding implementation of more precise static geo-targeting

Multi-Language Issue

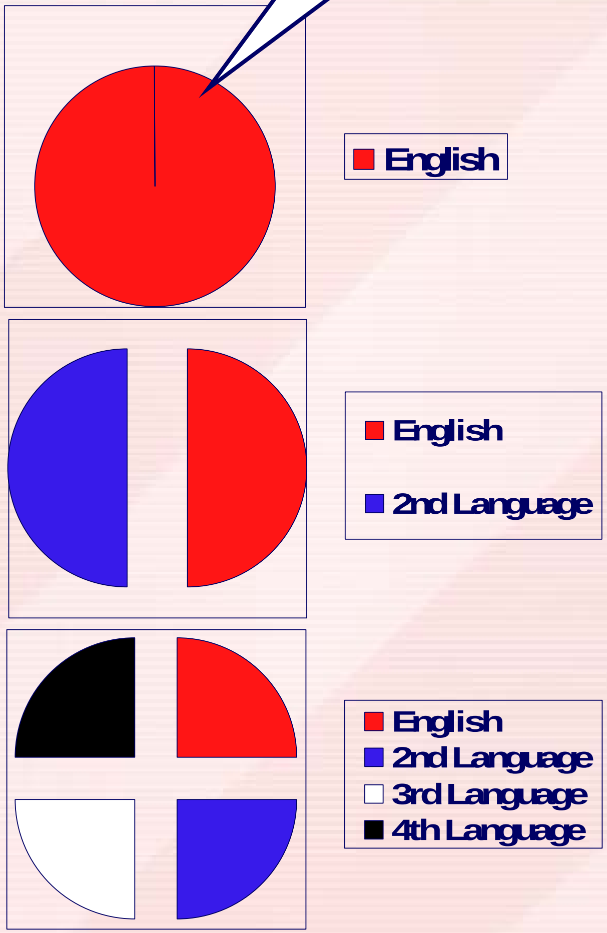
- WARN Act requests languages in addition to English to extent practical & feasible

- CMSAAC analyzed technical feasibility of supporting multi-language CMAS alerts on various delivery technologies & determined that support of languages other than English is a very complex issue

- Fundamental question: **How many languages other than English are feasible and practical for CMAS?**
  - On a national basis, only Spanish exceeds 1% of households
  - On a county basis, more than 37 languages that exceed 1% of households
    - Would required >16 different character sets to be supported in the mobile device
    - Additional character sets to support multiple languages also will potentially limit the amount of data that can be transmitted
      - Some character sets require 2 Bytes per character & would reduces text message to 45 characters

Multi-Language (continued)

- Technical limitations & support of multiple languages may result in significant impact to capacity & latency
- Radio Resource Limitations
  - Text service profile is limited to 90 characters
  - Each alert may be retransmitted
    ⇨ Reducing the number of Alerts supported
  - Multiple Alerts Types may occur simultaneously
    ⇨ Reducing the number of Alerts supported
  - Each added language will proportionally decrease the number of Alerts supported



Fixed Number of Alerts Supported

Multi-Language Recommendations

- **Provision has been made in CMAS architecture to support language extensions**
  - For example the C interface contains fields to identify language and character encoding

- **CMSP may choose to transmit alerts received in languages other than English based on:**
  - Capabilities of the technology the CMSP has deployed to support CMAS alerts
  - Capabilities of the mobile device
  - CMSP’s policy
  - Definition of a single unified National policy for the support of alerts in multiple languages

- **Alert Initiators would need to be able to generate the alert messages in multiple languages**
  - There shall be no language translation in the CMSP network or in the mobile device

A National Policy Needs to be Developed

Mobile Device Functionality for Wireless Emergency Alerts

Mobile Device Requirements

- **Consistent User Experience Across Devices & Operators**
  - Specific mobile device behavior is outside the scope of the WARN Act and, therefore, is not subject to recommendations by the CMSAAC

- **CMSAAC Recommendations address:**
  - Control of reception of alerts
    - Subscriber opt-out options
  - Notification of alerting
    - Audio attention signal and vibration cadence
  - Presentation of alerts
    - Functionality and features of the mobile device after the receipt of the alert message will be CMSP and mobile device specific

- **Legacy deployed mobile devices may not be supported**
  - At a minimum, new CMAS functionality is needed on future mobile devices
  - New mobile devices will be introduced by normal market mobile device lifecycle replacement

Key Mobile Device CMAS Functionality

- Monitor and detect broadcasted emergency alert messages
- Present emergency alert message to subscriber
  - Presentation controlled by subscriber opt out options on mobile device
  - Presentation including CMAS audio attention signal and vibration cadences as well as textual component of CMAS alert message.
- Detect & suppress presentation of duplicate emergency alert messages
  - Duplicates can be either from same or different cell sites
- No acknowledgement or response to received wireless alert message

Subscriber Opt-Out Options

- **WARN Act allows CMSP to provide subscriber an opt out process**
- **Subscriber opt-out process is mobile device function**
  - Default configuration is all alerts enabled.
- **Presidential-level alert messages must always be presented**
- **Recommended subscriber opt-out options:**
  - All messages
  - All severe messages
    - Severe messages are those messages where the CAP severity field is Severe, the CAP urgency field is Expected, and the CAP certainty field is Likely
  - AMBER Alerts
- **CMSPs & device vendors have flexibility on how to present the opt-out choices to subscribers**

Alert Audio Attention Signal & Vibration Cadence

- **Reproduction of existing EAS audio attention signal on mobile devices most recognizable method to notify American public of wireless emergency alert**
  - EAS uses two tone system for audio alerts which is combination of 853Hz and 960Hz sine waves
  - For devices with polyphonic capabilities, audio attention signal should be the EAS tones
  - For devices which with only single frequency alert tone capability, audio attention signal be in the low frequency range below 2.5 kHz
- **Recommended temporal pattern of audio attention signal**
  - One long tone of approximately 2 seconds
  - Followed two short tones of approximately 1 second each
  - Approximately ½ second gap between tones
  - Entire sequence is repeated twice with approximately ½ second between repetitions
  - Mobile device manufacturer specific
- **Vibration cadence for wireless emergency alerts**
  - Should be noticeably different from default cadence of mobile device
  - Should be similar to temporal pattern of audio attention signal
  - Mobile device manufacturer specific
- **Can not select alert audio attention signal or vibration cadence for any other mobile device function**

Cell Broadcast for Wireless Emergency Alerts

Cell Broadcast

- Cell Broadcast best solution currently available
  - Limited to text only messages
  - Supported by both GSM & UMTS

- “State of the Union” of Cell Broadcast Service (CBS)
  - Limited deployments and trials in the U.S.
  - Most handsets deployed today do not have cell broadcast capability
    - CBS menus are not visible to subscribers
    - Software for CBS may or may not exist in the handset
    - CBS in handsets have never been tested or validated

- Similar capacity for CDMA is SMS Broadcast

Cell Broadcast Basics

- GSM/UMTS feature that allows text broadcast to all mobile terminals in designated geographical area.

- Broadcasts areas can be one cell, many cells, or entire network

- Unconfirmed push service
  - Originator of the message does not know who has received the message

- Messages can only be received when the mobile is in CS idle mode or PS-Connected Mode UMTS
  - Implies need for periodic retransmission of alert messages

- Implementation of the terminal determines how the user accesses the message

Regulations & Future Activities

Next Steps With FCC

- FCC Notice of Proposed Rule Making (NPRM) issued in December 2007
  - Open comment period ended February 4, 2008
  - Reply comment period ended February 19, 2008
- FCC to issue Report & Order by April 9th, 2008
- In September 2008, CMSPs to provide to FCC their elections on whether or not they will transmit CMAS alerts

Next Steps in North American Standards

- Joint ATIS/TIA CMAS Standards Development
  - Specification of “C” interface between government Alert Gateway & CMSP Gateway
  - Specification of mobile device behavior for CMAS functionality
  - These specifications independent of cellular network technology
- ATIS (Alliance for Telecommunications Industry Solutions)
  - Specification for Reference Point E between CMSP infrastructure and mobile device for GSM/UMTS
- TIA (Telecommunications Industry Association)
  - Specification for Reference Point E between CMSP infrastructure and mobile device for CDMA
- All specifications to be completed before September 2008

Concerns Regarding Lack of Social Studies

- Limited social science or focus group studies have been performed
  - What will be the end user reaction to receiving these alert notifications?
    - End Users “clogging” 9-1-1 or operator customer care services for more information
    - Reaction when receiving alerts while driving, for example
- Social studies required to fully understand impact of the CMAS service offering

Future Research

- Geo-targeting
- Multi-language
- Limited social science or focus group studies have been performed
  - What will be the end user reaction to receiving these alert notifications?
  - End Users “clogging” 9-1-1 or operator customer care services for more information
  - Reaction when receiving alerts while driving, for example

Wireless Emergency Alerts & Amateur Radio

Wireless Emergency Alerts & Amateur Radio

- Support of emergency alerts not required by Amateur Radio
  - However, there have been questions raised at FCC if Amateur Radio should also be used to distribute emergency alerts

- Most Amateur Radio operators & ARES members have cell phones
  - Emergency alerts to their cell phones could provide indication to prepare for call out notifications or to connect to various ARES nets for instructions

Backup Slides

Acronyms

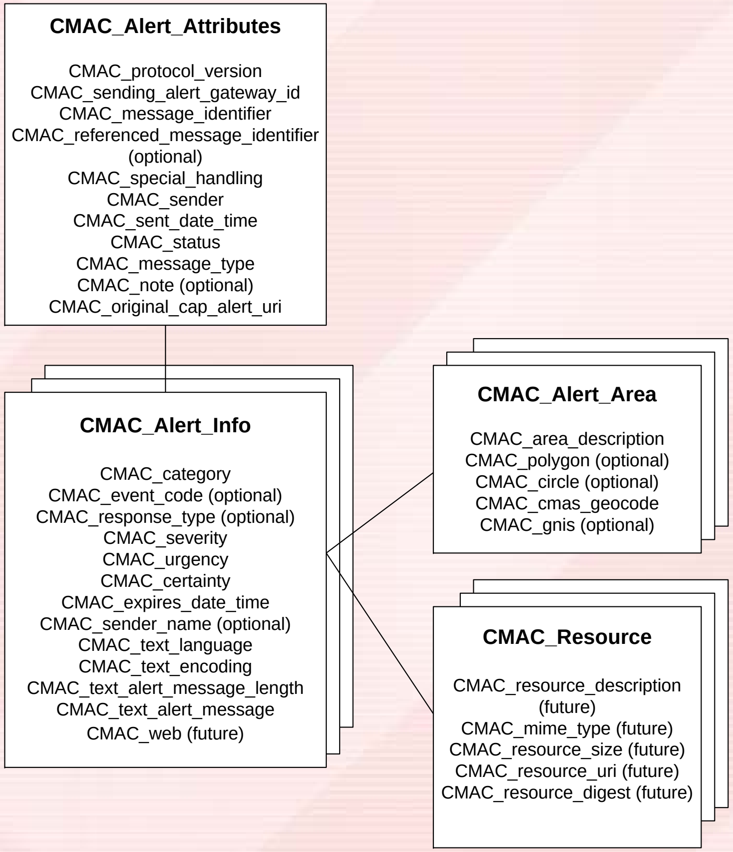
- CAP - Common Alert Protocol
- CBS - Cell Broadcast Service
- CMAS - Commercial Mobile Alert Service
- CMSAAC - Commercial Mobile Service Alert Advisory Committee
- CMSP - Commercial Mobile Service Provider
- EAS - Emergency Alert Service
- NWS - National Weather Service
- WARN - Warning, Alert, and Response Network

Why Not Point-to-Point Technologies?

- CMSAAC Recommendations consider point-to-point or unicast delivery technologies not feasible nor practical for CMAS for the following reasons:
  - Can experience significant delivery delays
  - Can result in network and radio interface congestion to the point of blocking voice calls
  - Lack security and can be easily spoofed
  - Lack geo-targeting capabilities because it is targeted to phone numbers instead of a specific alert area
  - Lack emergency alert specific audio attention signal & thereby emergency alerts can not be distinguished from normal SMS message traffic
  - Lack support of roamers

Structure of C Interface Message

- XML based
- One Alert Attribute segment
- One or more Alert Info segments
- One or more Alert Area segment per Alert Info segment
- Zero or more Alert Resources segments per Alert Info segment



CMAC_Alert_Attributes

CMAC_protocol_version
CMAC_sending_alert_gateway_id
CMAC_message_identifier
CMAC_referenced_message_identifier (optional)
CMAC_special_handling
CMAC_sender
CMAC_sent_date_time
CMAC_status
CMAC_message_type
CMAC_note (optional)
CMAC_original_cap_alert_uri

CMAC_Alert_Info

CMAC_category
CMAC_event_code (optional)
CMAC_response_type (optional)
CMAC_severity
CMAC_urgency
CMAC_certainty
CMAC_expires_date_time
CMAC_sender_name (optional)
CMAC_text_language
CMAC_text_encoding
CMAC_text_alert_message_length
CMAC_text_alert_message
CMAC_web (future)

CMAC_Alert_Area

CMAC_area_description
CMAC_polygon (optional)
CMAC_circle (optional)
CMAC_cmas_geocode
CMAC_gnis (optional)

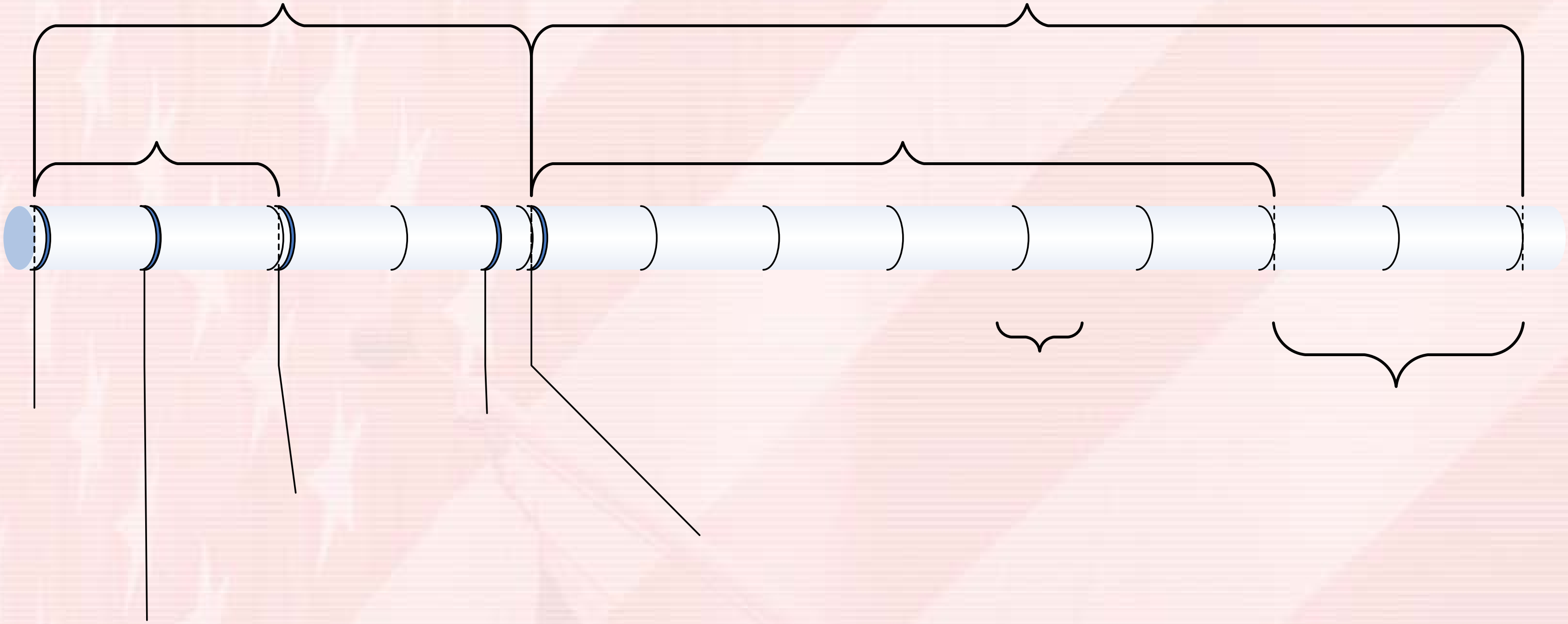
CMAC_Resource

CMAC_resource_description (future)
CMAC_mime_type (future)
CMAC_resource_size (future)
CMAC_resource_uri (future)
CMAC_resource_digest (future)

Anticipated Traffic Volume

- Vast majority of emergency alerts issued by National Weather Service (NWS)
  - Flash Flood Warnings & Tornado Warnings account for approximately all warning issued in 2006
    - 4,050 Flash Flood Warnings issued in 2006
    - 5,189 Tornado Warnings issued in 2006
- Approximately 1,200 child abduction emergency/Amber Alerts issued per year on a national basis
- Initial CMAS alerts for a single language of English assumed to be 25,000 per year on a national basis
  - Based upon above statistics & factor of uncertainty
  - Volume expected to increase due to additional usage of alert system
  - Volume expected to increase if additional language beyond English are supported

CMSAAC Proposed Deployment Timeline



Oct-07 - Oct-08

Questions?